

Remarks

Claims 1-17 are currently pending, and claims 1, 3, 11, 12, 14 and 17 are amended herein. The claims are amended herein to address the Examiner's requirements of form and to put the application in better form for appeal. Reconsideration is respectfully requested.

Amendment to the Specification

The Abstract is herein amended to correct typographical errors.

Rejections under 35 U.S.C. § 112

The Examiner rejects claims 1-17 under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Applicants traverse.

Claims 1, 14 and 17 are herein amended; the "new matter" rejection as applied to these claims is now moot.

Claim 4 recites, in part, that the 3-hydroxypropionic acid recovered is at least about 80% pure. Contrary to the Examiner's allegation that claim 4 recites new matter, support for this limitation is in the specification, e.g., at Example 1, Table 2. Example 1 discloses contacting an aqueous solution comprising acrylic acid and 3-hydroxypropionic acid with an organic extractant, centrifuging the mixture to separate the layers, and separating the layers. (p. 9, l. 21 to p. 10, l. 6) Table 2 shows the remaining percentages of acrylic acid and 3-hydroxypropionic acid in the aqueous and organic phases. A comparison of the amounts of acrylic acid and 3-hydroxypropionic acid remaining in the aqueous phase clearly demonstrates that the 3-hydroxypropionic acid is at least 80% pure in most of the trials. Applicants believe the specification provides support for claim 4 as recited and respectfully request withdrawal of the rejection.

Rejections under 35 U.S.C. § 103(a)

Claims 1-17 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Badische Anilin- & Soda-Fabrik AG, GB 1,167,793 (the '793 patent). Applicants traverse.

Amended claim 1 recites, in part, a process comprising separating and recovering 3-hydroxypropionic acid from an aqueous solution comprising 3-hydroxypropionic acid and acrylic acid, by contacting the aqueous solution with an organic phase comprising an organic extractant that is not ethyl acetate and wherein the organic extractant consists essentially of components having boiling points lower than about 100°C. (Support for this limitation can be found throughout the specification, e.g., p. 7, ll. 21-22.)

The ‘793 patent discloses a process for separating methacrylic acid and acrylic acid ((‘meth)acrylic acid’) from an aqueous solution using an organic solvent “...in which the boiling point of the solvent is higher than the boiling point of (meth)acrylic acid...” (Col. 2, ll. 72-74.) The meth(acrylic) acid is recovered from the organic phase by distillation. Specifically, the ‘793 patent discloses use of a radical lactam for separating (meth)acrylic acid from impurities comprising acetic acid and propionic acid. (Col. 3, ll. 4-9.) The Examiner states that the ‘793 patent also teaches use of mixtures of solvents such as aliphatics, cycloaliphatics or aromatic hydrocarbons, haloalkylhydrocarbons, ethers or esters. (Office Action dated February 5, 2007, page 3, citing the ‘793 patent, col. 2, ll. 95-102). This statement is a bit misleading because the ‘793 patent recites that these solvents may be used if mixed with at least 50% by weight of a radical lactam solvent. (‘793 patent, col. 4, lines 95-103.)

Because the ‘793 patent requires a solvent or solvent mixture having a boiling point higher than (meth)acrylic acid, i.e., greater than 100 °C, for the separation of (meth)acrylic acid, the ‘793 patent does not teach the process of amended claim 1.

Nor does the ‘793 patent suggest using an organic extractant consisting essentially of one or more components having boiling points lower than about 100°C. The Examiner alleges it would be obvious to a skilled artisan to use a low-boiling extractant for “reasons of ease of recovery of acrylic acid, either as solid or as an aqueous solution,” and that it would have been obvious to have “modified the reference teachings in separation of 3-hydroxypropionic acid and acrylic acid, with a reasonable expectation of success.” (Office Action dated February 5, 2007, pp. 4-5.) Rather than teaching or suggesting an organic extractant consisting essentially of one or more components having boiling points lower than about 100°C, the ‘793 patent specifically *teaches away* from using solvents with boiling points lower than about 100°C. The ‘793 patent enumerates several disadvantages of solvents with boiling points lower than about 100°C, including the necessity of distilling the solvent, difficulty in separating the solvent from (meth)acrylic acid by distillation, necessity of adding salt to the aqueous

phase, low partition coefficients, and failure to remove impurities, particularly propionic acid and acetic acid, satisfactorily. (Col. 2, ll. 40-64.) Thus, the '793 patent neither teaches nor suggests that an organic extractant consisting essentially of one or more components having boiling points lower than about 100°C could be utilized alone in the disclosed process or that an organic extractant consisting essentially of one or more components having boiling points lower than about 100°C could be advantageously utilized to separate compounds such as propionic acid and acrylic acid. Based on the '793 patent, one of ordinary skill in the art would conclude that solvents with boiling points less than that of acrylic acid or methacrylic acid (139°C and 161°C, respectively) would be unsuitable for the separation of acrylic acid and propionic acid. The Examiner cites no other reference or support for his allegation that use of the claimed solvents to carry out the claimed process of separation is obvious. For at least the reasons outlined above, Applicants believe claim 1 is allowable over the art of record.

Claims 2-13 depend directly or indirectly from claim 1 and are allowable for the same reasons discussed above, as well as based on each claim's unique and non-obvious combination of features. In addition, claim 5 recites, in part, a separation process of acrylic acid and 3-hydroxypropionic acid having a separation factor of equal to or greater than 5. The '793 patent does not teach or suggest a separation of acrylic acid and propionic acid that could achieve such a separation factor. This is in part due to the fact that the propionic acid is simply removed along with acetic acid and other impurities and is in part due to the inferiority of the lactam solvent as compared to the recited process.

Amended independent claims 14 and 17 are allowable for similar reasons to those discussed above in relation to claim 1. Additionally, amended claims 14 and 17 recite, in part, separation and recovery processes wherein the separation process of acrylic acid and 3-hydroxypropionic acid has a separation factor of equal to or greater than 5. As discussed above in relation to claim 5, the '793 patent does not teach or suggest a separation of acrylic acid and propionic acid that could achieve such a separation factor.

Claim 15 is allowable over the art of record for similar reasons to those discussed above in relation to claim 1 and claim 14, as well as claims 2-13. Claim 16 is allowable over the art of record for similar reasons to those discussed above in relation to claim 14, as well as based on the unique and non-obvious combination of features in claim 16.

Conclusion

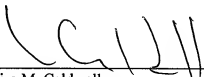
The claims in their present form should now be allowable. Such action is respectfully requested. The Examiner is invited to contact the undersigned attorney at the telephone number listed below if such a call would facilitate allowance of this application.

Respectfully submitted,

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